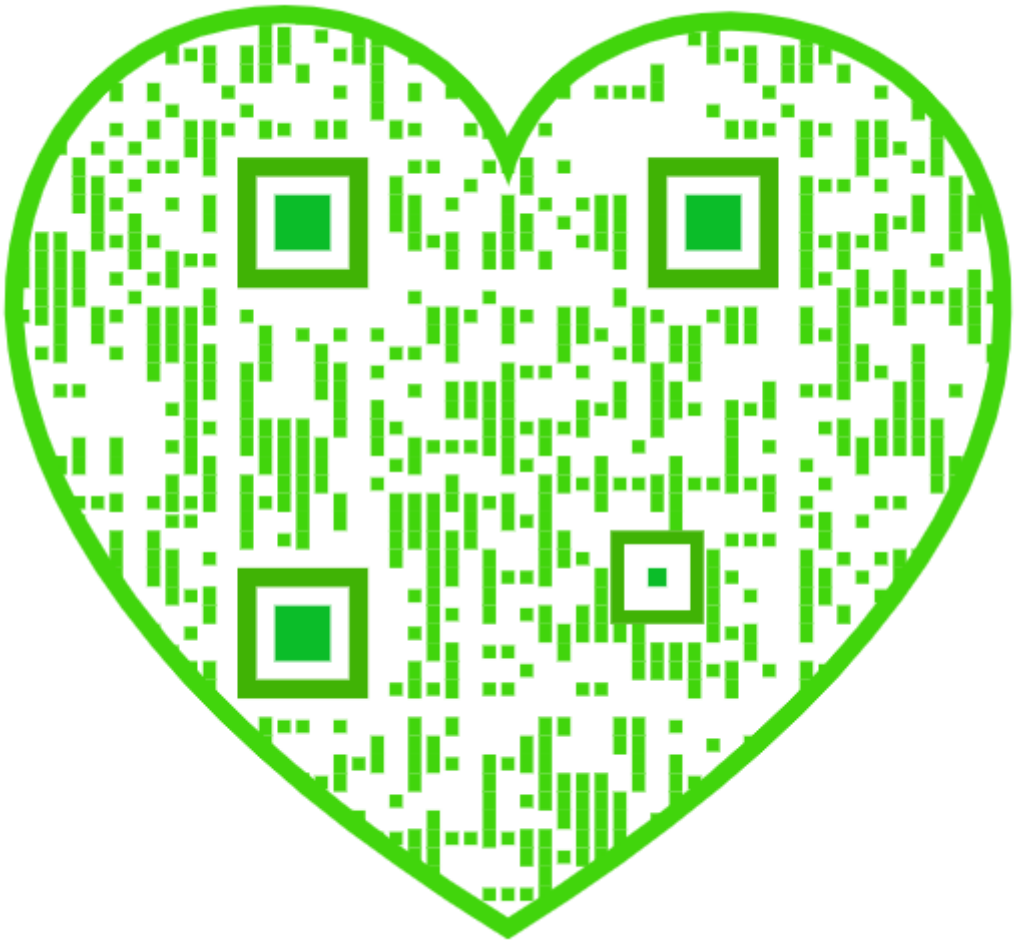
SUITABLILITY OF GRAPES FOR GENERAL CULTURE IN THE STATES OF THE OLD SOUTH

BY
FLOYD BRALLIAR, PH. D.

PUBLISHED UNDER THE DIRECTION OF
GEORGE PEABODY COLLEGE FOR TEACHERS
NASHVILLE, TENN.



SUITABLILITY OF GRAPES FOR GENERAL CULTURE IN THE STATES OF THE OLD SOUTH

BY
FLOYD BRALLIAR, PH. D.

UNIV. OF CALIFORNIA
LOS ANGELES LIBRARY

PUBLISHED UNDER THE DIRECTION OF
GEORGE PEABODY COLLEGE FOR TEACHERS
NASHVILLE, TENN.

UNIV. OF CALIFORNIA
LOS ANGELES LIBRARY

SB
389
B73s

TABLE OF CONTENTS

Foreword 6
Purpose 6
Scope 6
Incentives 6
Planting Trial of Vineyards 7
Location 7
Soil 7
Supplementary Observations 7
Acknowledgments 8

CHAPTER I

INTRODUCTION—GRAPES OF AMERICA

Grapes Among Ancients 9
Original Varieties Grown 9
Distribution of Wild Grapes 9
Grapes Indigenous to Tennessee 9
Early Attempts to Grow Grapes 10
Failures Explained 10
Success at Last 10
Vineyards in Tennessee 11
Other Southern Vineyards 12

CHAPTER II

VARIETY TRIALS

Trial Vineyard 13
Soil Selected 13
Preparation of Soil 13
Planting and Care 13
Weather Handicaps 13
Resetting 14
Further Plantings 14
List of Varieties 14
Care of Vineyard 17
Results 18

GW 5-27-40
6-30-59
Exchange
322821

Promising Varieties 18
Diseases and Prevention 19
Discussion of Varieties 19
Most Successful Varieties 20

CHAPTER III

GRAPE BREEDING

How to Proceed 21
Care of Seed 21
Growing Seedlings 21
Testing Seedlings 22
A Successful Seedling 22
Other Southern Breeders 23
Cheisholm 23
Munson 23
Zimmerman Brothers 23
Results 24

CHAPTER IV

VINIFERA GRAPES EAST OF THE ROCKY MOUNTAINS

Early Experiences 25
Characteristics of Vinifera 25
Tests in Tennessee 25
Results 26
Varieties Tested 26
On Own Roots 28
Other Southern Trials 28
In North Carolina 28
In Georgia 28
In Florida 28

CHAPTER V

RESPONSE TO ENVIROMENT

Behavior Variations 30
Worden 30

Delaware 30
Moore's Early 30
Niagara 30
Need for Experimental Vineyards 31
Appendix 32
Bibliography 33
Visits and Observations 35

FOREWORD

PURPOSE

The investigation herein reported was undertaken for four main objects:—First: To determine the possibility and practicability of the middle South and, so far as conclusions could be reached, the entire South growing not only its own supply of grapes but producing them commercially. Second: To ascertain what varieties of grapes already in existence are best suited to southern conditions. Incidentially, this includes a study of the variation of size and quality within a given variety due to local soil and climatic conditions. Third: The selection of parents most suitable for crossing in the hope of obtaining varieties preeminently suited to southern conditions. Fourth: An investigation of the possibility of growing the Vitis vinifera species of grapes in the South by taking advantage of our present knowedge of philloxera control and of the use of sprays in preventing blights, rots and mildews.

First Incentives.—About fourteen years ago (1908) a letter was received from Mr. Moore, a grape investigator of Burlington, Iowa, now deceased, stating that after much study he had reached the conclusion that the State of Tennessee must be about the geographic center of the grape's habitat, and suggesting that an investigation be made of the wild grapes of the state, and that a trial vineyard be started where grapes from all parts of the world could be tested. Observation and inquiry began about that time, but it was not until some five or six years later when a few Lutie grape vines were found growing by an old cabin on Paradise Ridge, some four miles from Joulton, Tenn., vines that had never known the benefits of knife, spray, or cultivation, yet were loaded with perfectly delicious fruit, that a decision was reached to make this trial planting. Though every good authority on grapes rated Lutie as a second rate variety, here in the hills of Tennessee, within thirty miles of its point of origin, it was the equal of any grape of American origin. If this were true of one variety, why might it not be true of others? To determine this, plans were laid for planting a vineyard. At first all that was contemplated was a plantation of the varieties that do best in the South; but on inquiry it became evident that no one knew which these varities were. A visit to the trial vineyard at the State Agricultural College revealed the fact that it had tested less than a score of the most common varieties. Correspondance with State horticulturists and personal visits to agricultural colleges and experimental stations were equally futile. Mr. Meir of Hendersonville, Tenn., had tested more varieties and gave more information than any one else.

PLANTING TRIAL OF VINEYARDS

After some preliminary attempts to establish a vineyard, work was begun in earnest by selecting a fairly well drained plot of land lying on the top of a ridge on the Nashville Agricultural Normal Institute's farm at Madison, Tennessee. The first grapes planted were Moore's Early, Niagara, Lutie, and Concord; and two years later Worden was added. The following year a further planting was made of Catawba, Caco, Norton, Winchel, and Herbert. In the fall of nineteen hundred seventeen another plot of land adjacent to these plantings was prepared, plants secured, and about one hundred sixty-eight additional varieties were set. The unit decided on for this plantation was five vines of a variety, though in several instances, either more or less than this number were planted. These variations appear in Chapter II. In nineteen hundred eighteen a number of additional varieties were planted, some of them being cross-bred seedlings produced on the place. A complete list of the varieties planted appears elsewhere.

In addition to the work done in this trial vineyard, personal observations have been made in various parts of every state in the old South except Louisiana, as well as in many of the border and northern states. Literally hundreds of miles were tramped through Tennessee, North Carolina, and North Georgia studying wild grapes.

ACKNOWLEDGMENTS

Much valuable data has been furnished by the horticultural departments of the various states, and especially by Mr. G. B. Hussman, Chief Viticulturist of the United States Department of Agriculture, and Mr. Morrell, Agriculturist for the Southern Railroad System. Mr. Antoine Wintzer, of the Conard-Jones Rose Company, West Grove, Pennsylvania, and Mr. G. B. Starcher, of Auburn, Alabama, should be especially mentioned for valuable assistance rendered in collecting cuttings and making observations.

CHAPTER I

INTRODUCTION -- GRAPES OF AMERICA

From the dawn of history the grape has been regarded as the king of fruits. When Moses sent spies into the promised land, (1)* as the most convincing evidence of its desirability, they brought back a giant cluster of grapes from Eschol. When Ruth gleaned in the field of Boaz, at noontide she was invited to dip her morsel in the "vinegar," a sweet marmalade made from the grape, (2) and among other things Abigail brought raisins to David to appease his wrath after his insult by Nabal. (3)

The Roman historian Tacitus states that the climate of Germany was cold and damp. In his day it would not produce the vine, and without doubt this was one of the chief reasons it escaped Roman dominion. (4)

Even the Vikings judged the value of a land by its ability to grow the vine, for in the Saga of Leif the Fortunate, we read that when he discovered a new land to the Westward (America), finding wild grapes, he gathered enough to load the stern of his vessel, and he named the country "Vineland." (5)

Grapes are found growing wild in most of Asia and Europe, though only a single species, Vitis vinifera, has ever been cultivated in those regions of either continent that have played an important part in history. In China and Japan, however, there are a few inferior wild grapes that do not belong to this species. Hundreds of varieties of this species have been developed, but they all agree in having a sweet firm flesh that does not part from the thin, tender skin; and in the soft, succulent roots that distinguish them from all other grapes. (6)

Until less than two centuries ago all cultivated grapes were of this species, so it is not surprising that it possesses many superior qualities not the least of which are its excellent table qualities and its ability to produce raisins.

In all the world some fifty or sixty species of grapes are known, depending upon classification, more than half of which are native to the United States. (7)

However, hardly a dozen species have ever been extensively cultivated, all but two of which are native American grapes and the eleventh, V. Bourquiniana, is doubtless an American hybrid. (8)

Six of these cultivated species are native to the South.

The State of Tennessee and the western part of North Carolina seem to be the geographical center of the grape world, containing more wild species than any other district of the world, with the possible exception of the region of the Brazos river in Texas.

---

* The figures in the text refer to authorities appearing in the Bibilography bering the key number.

The following grapes are indigenous to Tennessee: Vitis labruca, Vitis aestivalis, probably a few Vitis bicolor in the highlands bordering Kentucky, Vitis Bourquiniana, probably escpaed from cultivation, wild, Vitis cinerea, Vitis Baileyana on the borders of North Carolina, Vitis cordifolia, Vitis rubra, Vitis vulpina, Vitis Longii, and Vitis rotundifolia. (9) One or more of these are found on all soils in all districts of the State, while in some districts several of these varieties are found together with many natural hybrids.

Most of the wild grapes of Kentucky, Western Carolina, Tennessee, and Missouri grow on clay soil. Even where the soil is very poor they thrive abundantly. Farther south and southeast they grow on sandy soils. Naturally the varieties that thrive best on clay soils are not so well suited to the sandy districts.

Cultivated Grapes.—Seeing the wealth of wild grapes everywhere, the early explorers naturally concluded that grape growing would be one of the most profitable pursuits in the New World. (11) So it is not surprising that in sixteen hundred nineteen the Jamestown colonists were each required to put out and cultivate ten grape cuttings, and that for years every inducement was held out for growing vineyards. (13) (14) None of these vineyards were ever profitable and the vines soon sickened and died. Many attempts to grow grapes were made in all of the original colonies, but with little success. In Louisiana, only, was wine made profitably in quantities, and several large vineyards were established there, when the French, fearing their competition, forbade further wine making in the colony. (13) (14)

But all of these people made the mistake of neglecting the native grape and planted vinifera varieties imported from Europe. All reported that the vines grew thriftily for a year or two, then were taken with "a sickness" and died. The last attempt to grow European grapes on an extensive scale in Eastern America was on the Tombigbee river in Alabama. More than eleven hundred acres were set, professional growers being brought from France for the purpose. The success of the experiment seemed likely for some time, but disease and disaster were so great that the enterprise never paid expenses and the company finally became bankrupt and the vineyards were abandoned.

Gradually a few people, more wise than their fellows, turned to the native grape, and began selecting, crossing, and growing seedlings. The first real impetus to grape growing in America came with the introduction of a native grape, the Alexander, under the claim that it was from the Cape of Good Hope. (13) This was a native labrusca variety introduced late in the eighteenth century. Concord soon appeared, as a seedling produced in

Massachusetts, and Catawba was introduced into Maryland, doubtless having been carried there from the headwaters of the Little Catawba river, in North Carolina. (15) (16)

Grape culture was now a success in the North and East, but no record has been found of attempts made to grow grapes commercially in most of the South for years. However vineyards of Bourquiniana varieties were being profitably grown near Savannah, Georgia, as early as eighteen hundred and investigations have shown many small vineyards of Concord and Catawba from Columbia, South Carolina, northward to Hendersonville, North Carolina, that have been bearing for over twenty-five years, and evidence was obtained that at least one of these vineyards had been bearing since before the Civil War. (15) (17) (18)

Successful Plantations.—Doubtless the most successful attempt to grow grapes commercially in the South is in what is known as the thermal belt at Tryon, North Carolina. (19) (20) Mr. Lindsey, the pioneer grape grower of this district and today head of the Tryon Grape Growers' and Shippers' Association, after courteously showing a number of the vineyards, stated that the vines are uniformly heatlhy and productive. (15) Niagara and Deleware are principally grown, not because other varieties do not succeed, but because these were the first varieties planted and the reputation of the district was made on them. They are not only shipped locally in small quantities, but in car lots. They are grown on the steep mountain slopes, the higher the vineyard the better the quality of the fruit obtained. Good crops are secured on the low lands but the quality is not so good.

John Meir came from Spain, and in eighteen hundred ninety purchased land near Hendersonville, Tennessee, and began planting grapes. He states that he has planted more than sixty varieties during the time he has grown grapes there. He has the largest vineyard in Tennessee—twenty-seven acres, and reports good success from a financial standpoint. He secures as large an average yield as do the New York or Michigan growers, and gets a much higher price for his fruit.

In the vicinity of Graysville, Tennessee, A. K. Baker and William Lenker for a number of years grew grapes commercially, growing principally Brighton. Their venture was highly successful, as a visit to their vineyard in nineteen hundred sixteen showed.

In nineteen hundred fourteen Jethro Kloss set several thousand grape vines near Fountain Head, Tennessee. This planting was increased from time to time until it covered several acres. Mr. Kloss sold his farm and the vineyard was neglected for some time. Mr. B. N. Mulford now owns this vineyard and has partly resuscitated it. It is beginning to bear profitable crops.

In nineteen hundred sixteen W. S. Boynton planted an acre

of grapes near Douglasville, Georgia, on flat sandy land. In two years they were bearing large crops of marketable grapes and have borne regularly since.

In nineteen hundred seventeen and eighteen the Southern Junior College, at Ooltewah, Tennessee, planted several hundred grapevines consisting of Concord, Ives, Lutie, Niagara, Winchel and Norton. They are now producing profitable crops.

On the ridge above Dry Fork near Nashville, Tennessee, are sevearl vineyards of an acre or more each, in extent, mostly Concords, that are proving profitable.

The vineyard at the Nashville Agricultural and Normal Institute, near Madison, Tennessee, has been in bearing since nineteen hundred fourteen. The crop in nineteen hundred sixteen averaged eight tons per acre, and it did not fall below four tons per acre until in nineteen hundred twenty when the vineyard suffered severely from drought. In nineteen hundred twenty-one the grape crop was cut short by frost, but in nineteen hundred twenty-two the yield on all mature vines is averaging about two tons to the acre.

Small vineyards were visited at Jackson and Hazelhurst, Mississippi, at Austel, Atlanta and Griffin, Georgia, at Huntsville and McKinley, Alabama, and at Columbia and Johnson City, South Carolina. All were producing grapes of good quality. Reports have been received through Mr. Morrel, Agriculturist for the Southern Railroad, and from Mr. Zimmerman, of Florida, all agreeing that grapes are actually being produced in many other parts of the South in sufficient quantities to show that they are profitable. Figures obtained from A. C. Taite of Old Fort, North Carolina, show that his father has made a clear average profit of over three hundred dollars per acre on his vineyard for several years.

CHAPTER II

VARIETY TRIALS

As previously mentioned several settings of grapes were made on the land of the Nashville Agricultural Normal Institute at Madison, Tennessee (ten miles from Nashville) previous to 1918. In 1917 a plot of yellow clay soil lying adjacent to the latest planting already made, and only about three or four hundred feet from the other plantings was selected on which to plant a rather extensive trial vineyard. This site was selected because it was so near the dozen or more varieties already planted that it would be unnecessary to plant any of them again. The land was fairly well drained, lying on the crest of a ridge, sloping to the west and southwest. The soil was poor, but being clay could be built up. It was underlaid with strata of carbonate of lime and carbonate of magnesia at a depth varying from sixteen inches to six feet from the surface, but this fact was not known when the site was selected.

In 1917 this land was planted in corn for early roasting ears and in August was planted to Irish potatoes, no commercial and but little stable fertilizer being used. The potatoes were dug late in October and the land was sown to rye and crimson clover. During the winter sixteen tons per acre of stable manure were spread over this land. Early in March, when the cover crop was four or five inches tall, the land was plowed about eight inches deep and in April the grapes were set. The rows were placed eight feet apart, and the plants seven to twelve feet apart in the row, according to variety. Most varieties were planted eight feet apart in the row. Varieties such as Brilliant, and Deleware that were known to be weak growers were set only seven feet apart while some of the Munson varieties were planted twelve feet apart. No fertilizer was used at setting time.

Beans, soybeans, or cowpeas were grown between the rows the first summer, and after most of the pods had been picked, the tops were plowed under and the land again sown to rye, with a little crimson clover.

The first season was very dry, the drought coming in June. In July there were heavy rains, and then extreme drought again in August, lasting till November. As a result many of the vines died either before or during the winter of 1918-19.

In April of 1919 a cover crop was plowed under and most of the dead vines were replaced. Some that could not be replaced were reset with wholly new varieties.

They suffered even more from drought this second season, and the following winter was equally hard on the vineyard. In the

spring of 1920 we succeeded in putting the vineyard in pretty good condition and there has been little loss since. The following is a list of the varieties set. Those marked with $ failed to live, the number immediately after the $ show the number that died, again the number following show how many were reset. Those marked with * were reset in 1919, while those marked † were set for the first time in 1919. This list does not include the V. vinifera varieties as they appear elsewhere. This vineyard was planted in cooperation with the U. S. Dept. of Agriculture, it furnishing all vines bearing a number; the number being their nursery number.

All grapes are more or less subject to brown rot and bird's eye rot in this climate. As a preventative these grapes were sprayed three times in 1922, 4-4-50 Bordeaux mixture being used. Heavy and continuous rains prevented this giving the degree of protection that could reasonably have been expected but as all were treated alike the degree of susceptibility observed should be accurate. Those varieties only slighly subject to rot are marked 1. Those showing considerable disease are marked 2, while those in which the disease was so severe as to seriously damage the market quality of most of the bunches are marked 3. These numbers appear at the extreme right in the complete list.

Phylloxera has not been present thus far in great enough degree to make it possible to give an accurate study of variety susceptibility to this disease.

Leaf roller has given more or less trouble every season since the vineyard was planted. A few varieties seem wholly resistant to this insect while none seem conspicuously susceptible above the general average. Those that are resistant are marked* on the list of fifty.

No. Vines	*Variety*	*Vitality*	*No.*	*Resistance to rot*
2 *	Agawam	F	7842	2
3 $ *	Albania			2
5 †	Amber Queen	S	7845	2
5 *	Ambrosia	S	7846	2
4 *	America	R		1
5	Alexander Winter	F	6759	
5	Alice	F	6760	3
5 $ 2 *	Amerbonte		6765	1
5	Antionette	S	6766	2
5	Arkansas	F	6767	1
5 †	Armalaga	R		1
4 $	Atoka		6769	2
5	Bacchus	S	6648	2
5	Banner	F	6772	1
5 $ 1 †	Barry	F	6774	2

No.	*Vines*	*Variety*	*Vitality*	*No.*	*Resistance to rot*
5		Belle	W	6775	2
4	4 †	Berkmans	F-S	6652	1
1		Berkmans		6652	1
5	*	Brilliant	F		1
4		Bertha	F	6778	2
3	$ 1 †	Big Extra	S	6654	3
1		Big Extra	S	6781	3
5		Blondin	S	6782	2
5	$	Captain		6785	2
5	*	Captivator	F		2
5		Cayuga	F	6790	2
5	*	Carmen	W		2
5		Centenial	W	6791	2
5		Champenel	R	6792	1
3		Champion	S	6795	2
2		Champion	S	6794	2
5		Clevener	F	6797	2
5		Collier	F-W		2
5		Colombian Imp.	F	6803	2
5		Cornucopia	W	6805	3
5		Creveling	S	6806	2
5		Cunningham	W	6808	2
5	$	Big Hope		7856	2
5		Brighton	F	7858	1
5	*	Diogenese	F	7875	2
5		Delaba	F	6811	3
5		Delaware	F	6812	1
5		Diana	F	6672	2
5		Dracut Amber	F	6817	2
5	*	Eclipse	F		2
5	$ 2 †	Ellen Scott	F-S	6822	1
5	*	Edna	W		2
5	†	Elvira	F	6824	2
5	†	Emerald	F-W	6677	2
5	$ 1 †	Essex	F	6829	2
4		Etta	W	6832	2
1	$ 1 †	Etta	W	6831	2
4	*	Ellen Scott	F-S		1
5		Eumodel	W	6833	1
5		Eumelan	W	6835	1
3	$	Faith	S	6679	2
2	$	Faith	S	6836	2
5	*	Franklin	R	7892	2
5	*	Fern Munson	R		1
5	$ 4 †	Gaertner	F	6680	2
4	$ 3 †	Golden Drop	S	6840	2

No. Vines				*Variety*	*Vitality*	*No.*	*Resistance to rot*
1				Golden Drop	S	6840	2
5			*	Gold	F		2
1			*	Gold Dust	W		2
3	$	2	†	Govenor Ross	W	6683	2
2			*	Governor Ross	W	6683	2
5			*	Green's Early	F	7898	2
5			*	Grein's Golden	F	7899	2
3			*	Headlight	W		1
4	$	3	†	Helen Keller	F	6845	1
1				Helen Keller	F	6846	1
4				Herbert	F	6687	2
1				Herbert	F	6847	2
5				Hicks	F-S		1
2				Hopicans	F	6849	2
3	$	2	†	Hopicans	F	6850	2
1			$	Iona		6690	2
4			$	Iona		6853	
2				Isabella	S	6691	3
3				Isabella	S	6854	3
5			*	Ive's Seedling	S		1
3		3	†	Jaeger	F	6855	2
5			*	Jessica	F	7911	2
3				Kingsessing	W	6858	3
3			*	Last Rose	F		1
5			*	Linn	F	7916	2
1				Lindley's	S	6883	2
4	$	2	†	Lindley's	S	6864	2
5		5	†	Livingston	F	6866	3
4			*	Lomanto	F		1
5				Long John	F	6868	2
5		5	†	Louisiana	W	6869	1
4			†	Lukfata	R	6873	1
3	$	2	†	Manito	R	6875	1
5		5	†	Marguerite	S-R	6877	3
5				Massasoit	S	6880	2
4	$	1	†	Maxatawney	F	6881	2
1				Maxatawney	S	1881	2
5		5	†	Mericadel	S	6701	2
5				Merrimac	R	6882	3
5			†	Moyer	F	7928	2
5	$	2		Muench	R	6886	2
2			$	Oliatatoo		6710	2
3			$	Oliatatoo		6891	2
3				Onedia	W	6894	2
3				Oneida	W	6895	2
5		5	†	Paradox	F	6899	3

5	5	†	Peabody	F	6901	2
3			Prentiss	S	6909	2
5	$ 5	†	Poughkeepsie		7937	2
5		$	Pressley		7939	2
5	$ 3	†	Red Eagle	W	6913	2
4			Rockford	S	6919	3
1			Rockford	S	6920	3
5	1	†	Rommel	S	6926	2
5			Ronaldo	F	6928	2
5			Rupert	F	6929	2
5			Rebecca	R	6931	2
6		*	R. W. Munson	R		1
3			Salem	F	6923	2
5		†	Stark's Delicious	F		2
5			Triumph	F	6938	2
5			Valhalah	S-F	6939	2
5	$ 1	†	Vergennes	F	6719	2
4		*	Wine King	R		1
5			Wyoming Red	W	6946	2

At least 25 of each of the following had been planted before 1918 except Seedling No. 6.

Brighton	F
Catawba	F
Caco	F
Campbell's Early	F-S
Concord	F
Cynthiana	S-F
Diamond	S

Variety

Green Mountain (Winchel)	F-S
Lutie	F
Moore's Early	W-F
Niagara	S
Norton	S
Perkins	S
Pocklington	S
1 Vine Seedling No.	6F
Worden	F

Care of Vineyards

These grapes have not received as good cultivation as they should have had, and altogether have suffered more hardships than would be the case in the average vineyard. In a way this has been an advantage as it has helped show the weeknesses of the more undesirable varieties.

In 1921-1922 all grapes were carefully pruned and put on wires, the two-wire Kniffin system being used. All of the previous year's growth was carefuily measured and recorded in order to make a careful comparative study of their habits of growth. The growth up to August 1, 1922 was again studied, and the results of these two studies appear in the first list under vitality. The strongest growers are marked R (rampant), Those producing more than one hundred feet of new wood are marked S (strong growers) provided they did not show weak growth in 1922. Those making less than one hundred feet of new wood but more than fifty fair are marked F (fair) while those making still less growth are marked W (weak growers.) *

In a few instances failure to make strong growth might possibly be due to the nearness of rock formation under a vine, but as in most instances there are five vines of each variety, and as the average growth is taken in each case, the unfavorable location of a single vine does not give any serious discrepancy.

Late frosts in 1921 prevented many varieties fruiting at all, but a carefully tabulated study of quality, quantity, and character of fruit borne by every vine that fruited was made. A Similar study and record was made of these same varietiees in the United States Government test vineyard at Arlington, Virginia, in August of the same year.

In 1922 a similar careful study was made of the fruit in the trial vineyard at Madison. A severe hail storm on August 3, 1922 destroyed a great part of the fruit, however, so it was impossible to get the exact weight of the fruit on the different vines.

Most Promising Varieties

A list of the fifty most promising varieties is here given with a record of their behavior. Those marked H fruit heavily. Those marked M bear an average or moderate crop, while those marked F have only made a fair yield. It is not deemed necessary to list those that bore less than a fair crop. It must be understood however that the vineyard is young and some varieties come into bearing younger than others. On the other hand, the vineyard at Arlington, Virginia, is well established and should have corrected any errors in the Madison vineyard.

Agawam	T	M	Banner	T	H
America	J-T	F	*Berkman's	J-T	M
Armalaga	J-T	M	Brighton	T	M
Bacchus	J	M	Brilliant	T	F

* Since the above table was compiled all of these varities have been studied for two more years .But there has been no reason to change the relative rating of any of them, all now making an abundance of wood and are bearing well.

Captivator	T	M	Lomento	J-T	M
Campbell's Early	T	H	*Lukfata	J-T	M
Catawba	T	M	Lutie	T	M
Cynthiana	J-T	F	Last Rose	T	M
Concord	T	M	Mericadel	J-T	M
Delaware	T	F	Manito	T	M
Diamond (Moore's)	T	M	Moore's Early	T	F
Eclipse	T	M	Nectar	T	F
Ellen Scott	T-J	H	Niagara	T	H
Elvira	T-J	F	Norton's	J	H
Eumodel	T	M	Number 6	T	H
Eumelan	T	M	Peabody	J-T	M
Faith	J-T	M	Perkins	J	M
*Fern Munson	J-T	H	Pocklington	T	F
Golden Grain	T	F	*R. W. Munson	J-T	M
Gold Dust	T	M	Salem	T	M
Green Mountain	T	M	Stark's Delicious	T	M
Herbert	T	M	Wine King	J-T	F
Hicks	T	M	Wyoming Red	J-T	M
Hopicans	J-T	F	Worden	T	M
Ive's Seedling	J-T	H	Xenia	T	M

In the list above J means best for making grape juice, T for table use.

ADABTABILITY

Those grapes that after two fruiting seasons seem to be most reliable for general planting over a great district in the South are given in the list at the close of this chapter. Only such varieties are listed as have been observed or reported as succeeding in widely separated parts of the South. This list is of less value south of the latitude of Atlanta, Georgia than it is north of that line. All grapes included in this list are not of equal value as table grapes. To illustrate, Norton's Virginia bears heavy crops of grapes that are of great value for grape juice, jelly, etc., but are not satisfactory as table grapes. Wine King falls into the same class. Ives' seedling is a most excellent grape for these purposes but it is also a good table grape when well ripened, which means at least ten days after it has turned black.

Lutie and Ellen Scott are both free bearers of excellent grapes for home use but the former loses flavor quickly when picked and shatters badly, while the latter has a very thin skin and so bruises and bursts easily. Neither will do for distant market. Green Mountain is a most excellent table grape, but is too small to look attractive on the market. Worden is included in this

list because it is very fine where it succeeds, though it is not adapted to such a wide variation of soil and climate.

List of grapes recommended for planting in the South:

Armalaga
Banner (should be grafted)
Berkman's
Brighton
Campbell's Early
Catawba
Concord
Cynthiana (in places)
Delaware
Diamond (Moore's)
Ellen Scott
Enmodel
Fern Munson
Green Mountain
Ives' Seedling
Lutie
Moore's Early
Norton's
Number 6 (Seedling)
Niagara
R. W. Munson
Salem
Worden
Wine King
Wyoming Red

CHAPTER III

GRAPE BREEDING

The work of grape breeding herein reported began in the spring of 1916, though several crosses had been made in a neighbor's vineyard in 1913. Crosses were made between Concord, Lutie Moore's Early, Niagara, Diamond, Worden, Delaware, and later Green Mountain (Winchel). Each variety was used as a pollinator of every other variety except that Delaware was at no time used as a mother. The actual work was largely done by Botany and Biology classes under direction of the writer as teacher.

Just as a cluster of blossoms were opening and before any pollen had ripened all anthers were removed, either by hand or with tweezers, a reading glass being employed where necessary to make sure the work was thoroughly done. A cluster of blossoms, the pollen of which was ripe, was then brought from the other parent and the pollen thoroughly dusted over the emasculated cluster, which was at once enclosed in a tissue paper cap and labeled. By this method only a few of the blossoms on a cluster took the pollen and matured fruit, but this insured well matured seed. Grapes are more difficult to pollinate than many other flowers but the simple method used never failed to produce at least a few grapes.

The fruit was allowed to ripen thoroughly and was then gathered, the seeds saved, and planted, a label being placed with each lot. Some of the seeds were kept in a dry state for some months before planting, but all were planted before January 1, in cold frames without protection of any kind.

The percentage of germination has been uniformly good, but perhaps half of the seedlings produced have not lived for more than three months. They suffer from insect ravages, damping off and blight, and many of them die without any apparent reason. Seedlings are never sprayed or given any sort of protection as it is felt that only plants that are strong enough to succeed without protection would be strong enough for general cultivation. A good seedling should produce two or three feet of top the first summer.

When one year old all seedlings are transplanted to a nursery row and cut back to two inches in height. Here great loss is sustained, for reasons that have not been satisfactorily determined. These vines are cared for as if they were yearling vines brought from a nursery, being cut back hard each spring but are not sprayed. The first blossoms may appear the third year but some have never blossomed as yet.

The first fruit set on a seedling is almost sure to be small but it is possible to determine the color and flavor. Both size of berry

and size of bunch increased for three years or more, at the end of which time it is possible to determine the value of a seedling. There are always some vines that are pure males and as soon as this is determined they are destroyed.

Only one seedling of promise has appeared thus far. It is a Concord seedling pollinated with Delaware. This vine is now seven years old but was transplanted when three years old and suffered greatly as a result. This is designated in this dissertation as No. 6. This vine had never been sprayed until 1922, when, it was sprayed with the rest of the vineyard.

The plant is a strong grower but produces a slender vine with short internodes. The color of the bark on the young wood is rather distinctive, being a peculiar grayish color as if slightly mildewed. The foliage is ample but the leaf is not large. In outline and color it resembles the foliage of Concord.

Experiments show that this grape roots easily from ordinary hard wood cuttings, but the cuttings should be made rather early in the fall as the newly formed wood at the tips of the vine suffers from the winter, often killing back two or three feet. Otherwise the vine is hardy.

The vine is unusually productive, the blossoms being perfect and apparently self-fertile. The clusters are of medium size and vary somewhat in shape, though they are mostly slightly shouldered. The berry is black, or blue-black, closely resembling Concord in color. The size is still increasing but is not yet so large as Concord, though larger than the old and well known Clinton. The flavor is exceptionally good, resembling that of Deleware. The skin is unusually thin though it shows no tendency to crack.

The ripening period has not yet been fully determined. When it bore its first fruit it ripened with Moore's Early, and the following season it was ready to eat as early as Lutie and Green Mountain. In 1922 the fruit ripened only a week earlier than Concord, and fully ten days later than either Lutie or Green Mountain.

This grape has not shown the least susceptibility to rot or mildew of any kind, and has always produced well filled bunches until the present season, 1922, when in common with other varieties many of the flowers failed to set fruit, doubtless because of the almost continuous rains at blossoming time. *

Several other seedlings show vigor and disease resistance but have not as yet produced fruit, or if fruit has been produced, the quality is inferior.

* This grape has since shown susceptability to black rot, though it is more resistant than Concord.

Other Southern Grape Breeders

Soon after the close of the Civil War, Dr. L. C. Chisholm of Spring Hill, Tennessee, became interested in grape breeding as a recreation. No very complete account of his work is available, but for the purpose of this dissertation this is not needed. He produced three varieties of sufficient merit to be tested to some extent, but as none of them showed great merit in New York, they were never widely planted and were soon dropped from most nursery lists. However of these one, Lutie, was of such outstanding merit in the South, that it has gradually forced its way to the front, and information received by conversation with the Vitaculturist of the United States Department of Agriculture shows it is now being planted more widely than any other red grape in the United States. Its disease resistance, productiveness, and table qualities especially recommend it to the South. Its greatest weakness lies in the fact that it neither keeps nor ships well, and the crop does not ripen all at once. Naturally these are no disadvantage for home use.

Many inferior varieties have been sold for Lutie, hence its reputation has suffered in certain localities.

Observations made within ten miles of the site of its origin showed it growing luxuraintly on a trellis owned by D. K. Trenairy, though it had never been either sprayed or pruned, producing large crops regularly.

In 1873 Mr. T. V. Munson became intensely interested in grape culture. In 1876 he purchased land near Dennison, Texas, and began his life work of testing and breeding grapes. Mr. Munson spent thousands of dollars and traveled all over the United States studying wild grapes and collecting plants for his breeding station. He became the foremost authority on both the botany of the grape and grape breeding in America. He made thousands of crosses and grew tens of thousands of seedlings. Something more than a hundred of these have been offered to the public. None proved of great value in the North and hence they have not been widely planted or known.

They are very rapidly, gaining popularity in Texas and Oklahoma and recently have proven of great value in Florida where they are being planted by thousands. Wherever tested south of the Mason and Dixon line they are showing their value and are doing their part in proving that grapes produced in the South will yield profitable crops there.

The Zimmerman Brothers of Oldsmar, Florida have not only tested many of the Munson varieties but have used them as parent stock for growing seedlings. Today they are growing grapes very profitably, but invariably those giving best results are either their own or the Munson varieties.

All who have become intelligent on the subject agree that these two men, and especially Munson, have not only given us some of the finest flavored grapes known to cultivation, but have solved the question of grape growing in the South by providing varieties that are resistant to phylloxera, black rot, and bird's eye rot, the leading grape enemies in this region.

While it has proven impossible to secure reliable statistics, the United States Department of Agriculture, and the State Departments of Agriculture of Florida, Alabama, Tennessee, and North Carolina all agree that the production of grapes in the South is now on the increase. Florida alone reports an increase of six thousand acres of vineyard within the last ten years. A Grape Growers' and Shippers' Association has been formed with headquarters at Oldsmar. Growers predict that grape growing will soon take rank with orange culture in Florida.

CHAPTER IV

VINIFERA GRAPES EAST OF THE ROCKY MOUNTAINS

As before stated, practically all attempts to grow grapes in America before 1800 were failures because only the vinifera varieties were planted. (14)(25)(26) These attempts were made in widely separated parts of the country. The Jesuits near St. Louis, Missouri; Nicholas Longworth, Sr., near Cincinnati, Ohio; Dunfour in Kentucky; the Prices—father, son and grandson—on Long Island; a colony of Napoleon's exiled officers on the banks of the Tombigbee; and the old French settlers in Louisiana; all grew these grapes rather extensively, and in the early history of their enterprises with fair success. All had the same experience. In a few years the vines sickened and died; but no one at that period seems to have discovered the cause.

Vinifera grapes have soft, fleshy roots; a feature that distinguishes them from all other grapes. Everywhere east of the Rocky Mountains our wild grapes have always been more or less infested with small aphids known as phylloxera. These aphids begin their work on the leaves, but quickly move to the roots, where they live for years. These insects pierce the bark of the root with their beaks and suck the sap. Whether they inject an irritating substance into the root or whether the mere mechanical effect of the piercing injures the root is not fully determined. Whatever the cause, the roots soon develop knotty protuberances at the point of injury which hinder the free passage of sap. Of course this is just what the insect desires.

On most of our native species the bark is hard and very little injury is caused by the insect. But the soft, fleshy roots of the vinifera respond so readily to the work of phylloxera that they soon cease to develop new roots; and in a few months or, at most, years, the vine dies, Of our native grapes the labrusca suffer most from these insects; hence we would naturally expect phylloxera to be less abundant where this grape thrives in the wild state. This is true, but another difficulty is found here. Labrusca grapes are native where there is great and sudden variation in temperature. This is alike fatal to phylloxera and to vinifera grapes, both of which need an equable temperature.

TESTS IN TENNESSEE

In 1912 several hundreds of Vinifera grape cuttings were sent to the Nashville Agricultural Normal Institute from California for trial. These were either planted or distributed among affiliated institutions. They rooted promptly and grew rapidly, but many of them failed to survive the changeable weather of

the first winter. Most of those that survived grew readily the first half of the second summer, by which time, being unsprayed, the foliage was badly damaged by rot. In a few instances they grew three years and produced fruit of good quality, but by this time they became infected with phylloxera and soon died.

In 1914 some vinifera wood was grafted on wild vines by Neil Martin, near Bon Aqua, Tennessee, which took readily and made good growth. The second year some fruit was produced but being unsprayed the foliage became diseased. Unfortunately they had been grafted on slow growing vines, and the vinifera grew so much more rapidly than the vine on which they grew that they broke off in a wind storm and this experiment came to an untimely end.

In 1918 the appended list of vinifera grapes were obtained from the United States Department of Agriculture. They were sent from Chico, California, and did not arrive in good condition. Some of the roots were very dry. All were planted on a slight southwestern exposure on heavy clay soil, together with over a hundred American varieties. The season proved unusually dry. and many of the plants failed to grow. These were replaced the next spring, but a second even more severe and prolonged drouth prevented their growing well. The drought was so severe that the grapes withered on well established Lutie and Concord vines, and a number of six-year-old Lutie vines and three six-year-old Concord vines died outright. The unusually cold winter of 1919-20 following this drought killed most of the remaining vines together with nearly a hundred vines of various American varieties of the same age. It is felt that this experiment failed to show these grapes under normal conditions, yet several vines produced a few bunches of first class grapes, entirely free from mildew, rot, or other disease the second season. New settings under normal conditions are thriving, but are not old enough to produce fruit. All of these are grafted vines.

List of vinifera grapes planted on trial vineyard near Madison, Tennessee, in 1918. Only one vine of each was planted.

Variety	*Stock*
Alexandria	Joly
Angelina	Mont. x Rip.
Albardiens	Rup. St. George
Aramon	Mont. x Rip.
Burger	Constantia
Black Morocco	Rup. St. George
Bokator	Constantia
Blauer Portugieser	Constantia

Variety	*Stock*
Chass. dore	Mourv. x Rup.
Cinsaut	Mont. x Rip.
Corinthe Blanc	Berl. x Rip.
Corinthe Rose	Mont. x Rip.
Cornichon	Constantia
Chass. Rose de Falleaux	Rup. St. George
Chass. Rose Royal	Constantia
Dodrelabi	Rup. x Berl.
Damascus	Constantia
Emperor	Rup. St. George
Flame Tokay	Rip. x Rup. Jaeger
Green Hungarian	Rup. Des Semis
Jura Muscat	Constantia
Kadarka	Constantia
Lann Traube	Constantia
Luglienga Nero	Rip. x Rup.
Mantua de Philo	Constantia
Muscatel Frontignam	Mont. x Rip.
Ohanez	Berl. x Rip.
Olivette noir	Berl. x Rip.
Panariti	Rip. x Berl.
Panariti	Rup. x Berl.
Syrian	Constantia
St. Macaire	Rup. x Berl.
Sicilien	Constantia
Servan Blanc	Berl. x Rip.
Semillon	Rup. x Berl.
Terret Monsite	Rup. St. George
Trivolti	Constantia
Torock goher noir	Constantia
Teneron	Rup. St. George
Bermentino	Berl. x Rip.
Vahandova	Rup. St. George
Vigne de Zericho	Constantia
Veltliner	Mont. x Rip.
Verdel	Rup. St. George
White Tokay	Rup. x Berl.
Zinfandel	Constantia

Vinifera On Its Own Roots

In 1919 the acquaintance was made of a Mr. Poganani of West Grove, Pennsylvania. This man was acting as fireman in the Dingee and Conrad Rose Company's greenhouses. He proudly exhibited a home vineyard of vinifera grapes that were bearing heavily, though growing on their own roots. He offered to lead the way to a number of similar vineyards which he stated were doing as well as his own. Mr. Robert Pyle and Mr. Antoine Wintzer of the Conrad-Jones Company have reported this vineyard several times since, and sent cuttings from it. It is still thriving and bearing regularly.

This vineyard is growing in clay mixed with sharp sand. It was planted from cuttings some three feet long. The varieties are the three Muscatels and the cuttings were brought from Italy. Holes were dug eighteen inches deep and the cutting was coiled in the bottom of the hole until it just reached the surface. Mr. Poganani feels that this method of planting is important. The grapes are sprayed with Bordeaux mixture regularly every ten days or two weeks, and are carefully pruned and cultivated.

Other Southern Trials

In about 1910 Mr. Lindsay, of Tryon, North Carolina, received a number of varieties of vinifera grapes from the Department of Agriculture. These were grafted on resistant roots. They have received the same treatment as his other vineyards. When studied in 1921 they were thriving and Mr. Lindsay stated that they fruited regularly. He gave it as his opinion that vinifera grapes can be grown there, and with very little more trouble than the American varieties, if grafted on proper roots. Because of his well established and profitable trade in the American varieties and because of failing health, he has not increased his plantings.

In 1918 the Southern Railroad Company furnished one hundred vinifera grapes grafted on resistant roots for a trial in northern Georgia. Mr. Morrell reports that they are doing well and are already coming into profitable bearing.

In the Sixteenth Biennial Report of the Department of Agriculture of the State of Florida, F. J. Zimmerman, the leading authority on grape growing in Florida, states that "The vinifera varieties of Europe and California are found to do reasonably well only when grafted on phylloxera resistant roots." This doubtless refers to conditions in Florida.

Many additional instances observed or reported by Mr. Hussman, Chief Viticulturist of the United States Department of Agriculture, make it reasonably clear that if vinifera grapes are

grafted on resistant roots of a character that is adapted to the soil where they are to grow; and if the vines are regularly and carefully sprayed with 4-6-50 Bordeaux mixture, with arsenate of lead added when necessary to prevent insect ravages, vinifira grapes can be successfully grown over much of the South. It is safe to predict that there will be many small plantings of these grapes made in this section in the near future.

CHAPTER V

RESPONSE TO ENVIORNMENT

In studying grapes in different localities it soon became evident that a grape that succeeds in one locality may be of little worth in some other place. To illustrate, an attempt was made to grow Muscadine grapes dug on the banks of the Oostanaula River, Georgia, at Hillcrest, some eight miles from Nashville, Tennessee: but they made only indifferent growth and never bloomed.

Mr. Ed. Truitt of Franklin, Tennessee, reported most excellent success with Catawba grapes, and because of his success two hundred vines of this variety were set at Nashville Agricultural Normal Institute. They have been bearing for four years, but have given only ordinary results.

At Greenville, Tennessee Worden grapes were seen at their best. Prof. Albert C. Holt, dean of Tusculum College, near there, reported this as the most successful grape in his vicinity. On the contrary, Mr. John Muir of Hendersonville, Tennessee, one of the largest grape growers in the South, reports it as an unprofitable variety. In the vineyard in which the variety studies reported herein were largely made, it has succeeded fairly well, but not so well as Concord. As it grows for a neighbor on newly cleared land, it is extra good.

Delaware is generally reported to be a weak grower and a poor yielder. In North Carolina, especially around Tryon, it is productive and has proved a very profitable grape. In most of Tennessee it has done well.

In the Nashville Agricultural Normal Institute vineyard where these studies were made, Moore's Early has never produced enough grapes to be profitable, and the quality is poor. On Mr. Muir's place at Hendersonville, Tennessee, it produces large enough crops to be profitable because of its earliness.

Concord has proven to be a grape of great adaptability. It usually succeeds even where others fail, but at Mr. Cantrell's place near Austell, Georgia, it failed; while Niagara, a grape that is usually subject to disease, was giving good results when observed in 1915.

As mentioned above, Niagara was found fruiting heavily at Austel, Georgia, without having been sprayed. At Tryon, North Carolina, it is the leading grape grown. It has been observed three seasons fruiting well at Farm School, near Swanninoah, North Carolina. Where these studies were made, it bears heavy crops, but is very subject to disease and so requires extra spraying. Mr. Lindsey gives the information that at Tryon, North Carolina, it is as disease resistant as Concord.

Not far from Mobile, Alabama, at Gulfport, there are according

to the reports of Mr. Russell, formerly of Nashville, Tennessee, Mr. Starcher, State Entomologist of Alabama, and Mr. Morrell, Agriculturist for the Southern Railroad Company, several small plantings of an unidentified grape of the Concord type, known locally as the Indiana grape because of having been brought from that state. It is thriving and yielding good crops regularly without any special care in a region where it is considered impossible to grow such grapes.

These facts, together with many similar ones that could be given, show the importance of experimental vineyards in many places in the South. This is especially important because in the past very little such work has been done, in any of the southern states and, as a consequence, no one knows with any degree of certainty whether any given variety of grape may be set with a reasonable expectation of giving profitable returns. From the fact that it is expensive to set a vineyard and care for it for three or four years until it comes to bearing, few people are willing to take the chance unless they are reasonably sure of results.

The various state experiment stations would render a great service to the public were they to plant more or less complete trial vineyards and report the results to the public. When this is done, one or more varieties of grapes now in cultivation are likely to be found suitable to most districts in the South, and can be grown profitably.

APPENDIX

GRAPES: NUMBER OF VINES IN THE SOUTH A PER U. S. CENSUS.

State	*Vines of Bearing Age*	*Vines not of Bearing Age*	*Production* 1919 *lbs.*
North Carolina	543734	114582	10679108
South Carolina	87487	27874	2016506
Georgia	182119	38588	2865319
Florida	57840	29767	1220623
Kentucky	327429	69439	1497769
Tennessee	359972	98928	1839450
Alabama	183759	60995	1446814
Mississippi	56912	24041	760563
Louisiana	19601	12583	67203

AVERAGE PRODUCTION PER VINE IN POUNDS

Data furnished by the various State Horticulturists and from U. S. Census reports.

North Carolina	20
South Carolina	24
Georgia	15
Florida	21
Kentucky	4
Tennessee	5
Alabama	7
Mississippi	14
Texas	3
Louisiana	3
New York	5

This table shows conclusively that the average production of grapes per vine in the South is fully equal to that in the North.

BIBLIOGRAPHY

(*Numbers here given correspond to numbers in the text*)

1. Bible, Numbers 13:23.
4. Tasitus, Bohn's Classical Library, Vol. I, page 184.
2. Bible, Ruth 2:14.
3. Bible, I Sam. 25:18.
5. Barnes, Studies in American History, *Subject*, The Vikings.
6. Hedrick, Grapes of New York, page 1.
7. Hedrick, Manual of America Grape Growing, page 1.
8. Munson, Foundations of American Grape Culture, pp. 55-60.
9. Munson, Classification and Generic Species of the Wild Gapes of North America.
10. Phin, Open Air Grape Culture, pp. 1, 2.
11. Phin, Open Air Grape Culture, pp. 22-29.
12. Hedrick's Grapes of New York, Chapter IV.
13. Hedrick's Grapes of New York, Chapter I.
14. Phin, Open Air Grape Culture, Chapter I.
15. Lindsey, W. T., Tryon, N. C. Conversation and private letters.
16. Garrison, W. A. B., Blackmountain, N. C. Conversation and private letters.
17. Little, G. F. Conversation and private letters.
18. Davis, H. S. University of S. C., Colombia, S. C. Private conversations.
19. Hussman, G. B. Dept. of Agriculture, Washington, D. C. Personal information.
20. Personal visits and observations.
21. Hussman, American Grape Growing and Wine Making, p. 6.
22. Emerson, Story of the Vine, *Subject*, Pruning.
23. Hedrick, Manual of American Grape Growing, pp. 132-138.
24. Hussman, American Grape Growing and Wine Making, pp. 62-64.
25. Phin, Open Air Grape Culture, Chapter I.
26. Phelps, The Vine; its Culture in the United States, *Subject*, Early Grape Plantations.
27. Fisher, Observations on the Character and Culture of the American Vine, Chapter I.

Authorites Consulted but not Quoted.

1. American Pomological Society—Report from 1852 to date.
2. Andre—A Guide to the Cultivation of the Grape Vine in Texas, and Instructions for Wine Making.
3. Antill—An Essay on the Cultivation of the Vine, etc.
4. Bailey—American Grape Training
5. Bright—Single Stem Dwarf Renewal System of Grape Culture.
6. Buchanan—The Culture of the Grape and Wine Making.
7. Cope—Physiography in its Application to Grape Culture.

322821

8. Corlton—The American Grape Growers' Guide.
9. Denniston—Grape Culture in Stauben County, New York.
10. Dept. of Agriculture, U. S. All bulletins to date.
11. Dept. of Agriculture, Florida—Sixteenth Biennial Report.
12. Dept. of Agriculture, New York—Grape Culture in Steuben County.
13. Dept. of Agriculture, New York. —The Grape Belt.
14. Dept. of Agriculture, Kansas—The Grape.
15. Dufor—The American Vine Dresser's Guide.
16. Eisen—The Raisin Industry.
17. Emerson—Story of the Vine.
18. Florida—Grape Growers' Association—Annual Reports.
19. Fuller—The Grape Culturist.
20. Goesman—Contribution to the Chemistry of the American Grapevine.
21. Grant—Manual of the Vine.
22. Haraszthy—Grape Culture; Wines and Wine Making.
23. Haskell—An Account of Various Experiments for the Production of New and Desirable Grapes.
24. Hussman—Cultivation of the Native Grape and the Manufacture of American Vines.
25. Hore—Practical Treatise on the Cultivation of Grape Vine.
26. Hofer—Grape Growing.
27. Hyatt—Handbook of Grape Culture.
28. Keech—Grape Growers' Guide.
29. Longworth—The Cultivation of the Grape and the Manufacture of Wine.
30. McMinn—A Contribution to the Classification of the Species and Varieties of the Grape.
31. McMurtie—Report Upon Statistes of Grape Culture and Wine Production of U. S. A. for 1880.
32. Mead—An Elementary Treatise of American Grape Culture and Wine Making.
33. Mitzky—Our Native Grape.
34. Mohr—The Grape Vine.
35. Phin—Open Air Grape Culture.
36. Prince—Treatise on the Vine.
37. Rafinesque—American Annual Grape Vines.
38. Reemiln—The Vine Dresser's Manual.
39. Saunders—Both Sides of The Grape Question.
40. Speechly—A Treatise on the Culture of the Vine.
41. Spooner—The Cultivation of American Grape Vines.
42. Strong—Culture of the Grape.
43. Tryon—A Practical Treatise on Grape Culture.
44. U. S. Census Buelletins, 1920.
45. Wait—Wines and Vines of California.
46. Woodward's—Graperies and Horticultural Buildings

VISITS AND OBSERVATIONS

West Grove, Pa.
Florence, S. C.
Wilmington, S. C.
Tusculum, Tenn.
Asheville, N. C. and vicinity
Vicksburg, Miss. and vicinity
Berea, Kentucky
Winchester, Tennessee
Graysville, Tennessee
Douglasville, Georgia
Austel, Georgia
Selma, Alabama
Hazelhurst, Miss.
Columbia, S. C.
Johnson, S. C.
Tryon, N. C.
Knoxville, Tenn.
Greenville, N. C. and vicinity
Hattesburg, Miss. and vicinity
Murfreesboro, Tennessee
Chattanooga, Tennessee
Atlanta, Ga. and vicinity
Reeves, Georgia
Huntsville, Alabama
McKinley, Alabama
Jacksonville, Miss. and vicinity

1. Dept. of Agriculture, U. S.—Private letters from Mr. Hussman.
2. Dept. of Agriculture, Georgia—Private letters.
3. Dept. of Agriculture and Commerce, Mississippi—Private letters.
4. Dept. of Agriculture, South Carolina—Private letters.
5. Dept. of Agriculture, Kentucky—Private letters.
6. Dept. of Agriculture, Florida—Private letters.
7. Morrell, Southern Railroad agriculturist—Conversations, letters.
8. Obermeier, Giess, Parkersburg, W. Va.—Conversation and observation.
9. Starcher, W. B.—Conversations and letters.
10. Taite, A. C., Old Fort, N. C.—Conversations and observations.
11. Tryon, N. C.—Observations and visits to orchards.
12. Wade, Florry, Calhoun, Ga.—Conversation.